REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-11 are currently pending, Claims 1, 10, and 11 having been amended. The changes and additions to the claims do not add new matter and are supported by the originally filed specification, for example, on page 31, line 6 to page 32, line 3; page 43, line 18 to page 44, line 22; and Figs. 8-11.

In the outstanding Office Action, Claims 1-11 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite; Claims 1-6 and 10-11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Butter et. al. (U.S. Patent No. 6,549,575 B1, hereafter "Butter") in view of Karczewicz et al. (U.S. Patent No. 6,950,469, hereafter "Karczewicz"); Claims 7 and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Butter in view of Karczewicz and Park et al. (U.S. Patent No. 5,825,930, hereafter "Park"); and Claim 9 was rejected under 35 U.S.C. §103(a) as being unpatentable over Butter in view of Karczewicz and Legall (U.S. Patent No. 5,761,398).

With respect to the rejections of Claims 1-11 under 35 U.S.C. §112, second paragraph, Applicants respectfully submit that the present amendments to the Claims 1 and 7-11 overcome these grounds of rejection.

With respect to the rejections of Claim 1 under 35 U.S.C. §102(b), Applicants respectfully submit that the amendment to Claim 1 overcomes this ground of rejection. Amended Claim 1 recites, *inter alia*,

> determining motion vector search ranges respectively within the plurality of reference frame images based on a plurality of size-reduced reference images reduced in size corresponding to the size-reduction ratio of the size-reduced block by detecting motion vectors respectively within the plurality of size-reduced reference images and increasing a size of the motion vectors by linear

> interpolation to provide motion vector search ranges with respect to the plurality of reference frame images which correspond to an increased size of the motion vectors, wherein for each layer of a frame image except a lowermost layer, motion vectors are detected within a search range which includes a plurality of peripheral pixels in a rectangular range having apexes corresponding to start and end points of a motion vector detected in a lower layer.

Applicants respectfully submit that Butter and Karczewicz fail to disclose or suggest at least these features of amended Claim 1.

Butter is directed towards a method of hierarchically searching a reference picture to find a suitable macroblock for constructing a motion vector between the reference picture and a current picture. Fig. 2 of Butter shows that there are three types of pictures: intra pictures ("I" pictures), predicted pictures ("P" pictures), and Bi-directional pictures ("B" pictures). The I pictures are encoded and transmitted as a whole and serve as a source of motion vectors. The P pictures are formed by motion vectors from a previous picture and can serve as a source of motion vectors for further pictures. The B pictures are formed by motion vectors from two other pictures and cannot server as a source of motion vectors (see col. 5, lines 17-28). Fig. 3 shows a method of motion estimation, in which neighboring frame is searched to find a macroblock 213 which best matches a macroblock 211 in a current frame (see col. 5, lines 29-34). Such a process will yield motion vectors which translate the position of an image from picture to picture (see col. 5, lines 39-41). In performing the search, Butter describes a hierarchical search unit 201 in Figures 5 and 6 that normally performs a search using down-sampled data (see col. 6, lines 3-5). The search unit 201 stores and fetches luminance search data for both I and P frames (see col. 6, lines 9-11). The luminance search data is equivalent to the inputted current macroblock (CMB) with downsampling applied if selected by the user (see col. 6, lines 13-5).

Butter describes that the search unit 201 performs a typical search using downsampled full pixel values. After the best downsampled match is determined using non-reconstructed current macroblock (CMB) data from past and/or future I and P frames, a refinement search unit 221 performs a non-downsampled full pixel search using reconstructed refinement search data around the offset of the best downsampled match (see col. 6, lines 57-64).

Thus, Butter describes searching a reduced (downsampled) macroblock first, and then refining the search by searching a non-reduced (non-downsampled) macroblock "around the offset" of the best downsampled match. However, Butter does not explicitly describe that the refinement search within the non-downsampled match is performed "within a search range including a plurality of peripheral pixels in a rectangular range having apexes of start and end points of a motion vector detected in a lower layer," as defined by amended Claim 1.

Therefore, Applicants submit that Butter fails to disclose or suggest "determining motion vector search ranges respectively within the plurality of reference frame images based on a plurality of size-reduced reference images reduced in size corresponding to the size-reduction ratio of the size-reduced block by detecting motion vectors respectively within the plurality of size-reduced reference images and increasing a size of the motion vectors by linear interpolation to provide motion vector search ranges with respect to the plurality of reference frame images which correspond to an increased size of the motion vectors, ***wherein for each layer of a frame image except a lowermost layer, motion vectors are detected within a search range which includes a plurality of peripheral pixels in a rectangular range having apexes corresponding to start and end points of a motion vector detected in a lower layer***," as defined by amended Claim 1.

The Office Action further acknowledges that Butter fails to disclose or suggest using linear interpolation to increase a size of the motion vectors (see Office Action, at page 5).

The Office Action relies on Karczewicz to remedy the deficiencies of Butter with regard to Claim 1.

Karczewicz is directed to a method for sub-pixel value interpolation in encoding and decoding video. Figs. 20-22 shows a method of interpolating sub-pixels with up to 1/8 resolution. Karczewicz describes that sub-pixels with different resolutions (such as sub-pixels b^i or c^{ij}, which have a ½ or ¼ resolution, or sub-pixel d which has a 1/8 resolution) are calculated using values of nearby image pixels (see col. 42, lines 5-59). The Office Action appears to take the position that this description of Karczewicz describes using linear interpolation to increase a size of a motion vector (see Office Action, at page 5). However, this portion of Karczewicz describes interpolating sub-pixels, which is calculating smaller resolution sub-pixels based on the values of known neighboring sub-pixels. This portion does not describe increasing a size of a motion vector using linear interpolation.

Additionally, Karczewicz does not describe "wherein for each layer of a frame image except a lowermost layer, motion vectors are detected within a search range which includes a plurality of peripheral pixels in a rectangular range having apexes corresponding to start and end points of a motion vector detected in a lower layer," as defined by amended Claim 1.

Therefore, Applicants submit that Karczewicz fails to disclose or suggest "determining motion vector search ranges respectively within the plurality of reference frame images based on a plurality of size-reduced reference images reduced in size corresponding to the size-reduction ratio of the size-reduced block by detecting motion vectors respectively within the plurality of size-reduced reference images and ***increasing a size of the motion vectors by linear interpolation to provide motion vector search ranges with respect to the plurality of reference frame images which correspond to an increased size of the motion vectors, wherein for each layer of a frame image except a lowermost layer, motion vectors are detected within a search range which includes a plurality of peripheral pixels in a***

rectangular range having apexes corresponding to start and end points of a motion vector detected in a lower layer," as defined by amended Claim 1.

Therefore, Applicants submit that Karczewicz fails to remedy the deficiencies of Butter with regard to amended Claim 1.

Therefore, Applicants respectfully submit that amended Claim 1 (and all associated dependent claims) patentably distinguishes over Butter and Karczewicz, either alone or in proper combination.

Park and Legall have been considered but fails to remedy the deficiencies of Butter and Karczewicz with regard to amended Claim 1. Therefore, Applicants respectfully submit that amended Claim 1 (and all associated dependent claims) patentably distinguishes over Butter, Karczewicz, Park, and Legall, either alone or in proper combination.

Amended independent Claims 10 and 11 recite features similar to those of amended Claim 1 discussed above. Therefore, Applicants respectfully submit that amended Claims 10 and 11 (and all associated dependent claims) patentably distinguish over Butter, Karczewicz, Park, and Legall, either alone or in proper combination.

Consequently, in light of the above discussion and in view of the present amendment, the outstanding grounds for rejection are believed to have been overcome. The present application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

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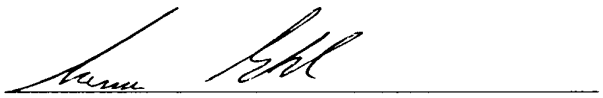

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